MEETING PROGRAM & ABSTRACTS

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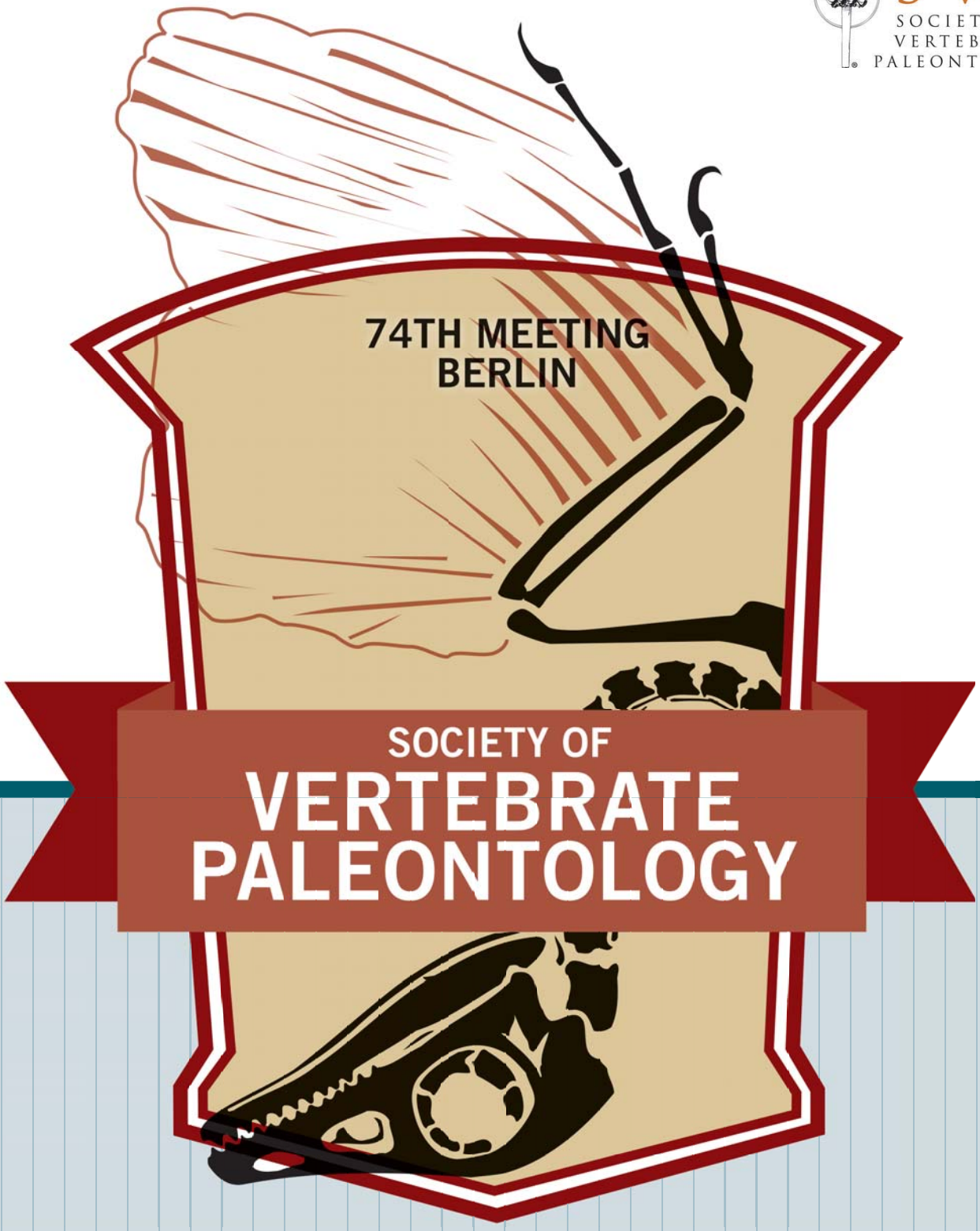

November 5 – 8, 2014 • Estrel Berlin • Berlin, Germany

found and they represent the most complete meiolaniid known from South America. This new species differs from other meiolaniids in the peculiar thick half-moon shaped rim surrounding the cavum tympani, the presence of three cranial scutes K, an unenclosed canalis chorda tympani mandibularis, among other characters. The preliminary cladistic analysis, based on recent analysis of meiolaniforms, suggests this new species belongs to Meiolaniidae. However, due to the presence of few elements in common between this species and other meiolaniids, its phylogenetic position is not stable inside the clade. The paleobiogeographic analysis shows that meiolaniids would have originated in the area that is today represented by Antarctica, however there is no fossil record supporting this hypothesis. The comparison of the evolution of meiolaniforms with other amniotes suggests a common paleobiogeographical history of these clades in southern Gondwana. Furthermore, different proxies highlight that the paleobiogeographical history of meiolaniids is also controlled by the major climatic changes occurred during the Cenozoic caused mainly by the breakup of southern Gondwana.

Poster Session II (Thursday, November 6, 2014, 4:15 - 6:15 PM)

PALEOBIOLOGICAL PATTERNS IN THE LATE OLIGOCENE NSUNGWE FORMATION FAUNA, SOUTHWESTERN TANZANIA

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Field and laboratory studies of fossils from the western branch of the East African Rift System in southwestern Tanzania document a complex basin history with multiple Paleozoic–Cenozoic tectonic and depositional events. The Cenozoic depositional history of the Rukwa Rift, a key segment of the western Branch, is characterized by proximal alluvial fan systems that transitioned into a complex, volcanically-influenced landscape of fluvial, alluvial, and lacustrine depositional environments. Late Oligocene fossil-bearing facies of the Nsungwe Formation are dated at ~26–24 Ma via high-precision U-Pb and Ar/Ar geochronology of intercalated volcanic tuffs. Recent discoveries document the oldest African boid snake, the earliest evidence of venomous elapid snakes on the African continent, and the oldest colubroid-dominated snake fauna in Africa. A predominance of active foraging predator species dovetails well with sedimentology-based paleoenvironmental reconstructions of seasonal aridity in the region. The Nsungwe Formation fauna also contains the earliest evidence of the endemic African ranoid frog family Ptychadenidae in addition to a rare xenopodinomorph pipid frog. Localities in the late Oligocene Songwe Member of the Nsungwe Formation notably preserve a diverse mammalian fauna including rodents, macroscelideans, hyracoids, and anthracotheres. Significant primate discoveries include the first lorisiform from Africa south of the equator, the latest record of parapithecids, and the earliest evidence of the split between cercopithecoids and hominoids. Other vertebrate clades are preserved in the fauna, represented by articulated turtle and fish materials and avian cranial and postcranial elements, in addition to crocodylian and lepidosaurian remains. Nsungwe Formation discoveries offer a glimpse at the evolutionary history of late Oligocene terrestrial and freshwater habitats in eastern Africa, providing data on the complex tectono-sedimentary history of the Rukwa Rift Basin. Continued exploration offers a refined perspective on the Paleogene–Neogene transition on continental Africa, with expanded opportunities for recognizing trends in paleobiological diversity across habitat types and through time.

This research was supported by National Geographic Society (CRE), LSB Leakey Foundation, Ohio University African Studies Program, Ohio University Heritage College of Osteopathic Medicine, and the National Science Foundation (EAR 0617561; EAR 0933619; BCS 1127164; EAR 1349825).

Symposium 4 (Friday, November 7, 2014, 11:00 AM)

THE SALT OF LIFE: EURYHALINITY AND HALOTOLERANCE IN TEMNOSPONDYLS

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According to paleoenvironmental, paleogeographical, and/or morphological reconstructions, the first tetrapods were euryhaline: their Late Devonian bodyfossils are found mostly in margino-littoral paleoenvironments and they correspond to rather aquatic animals unable to sustain their own bodymass on land. This euryhalinity could be linked with their polydactyly because the same Hox genes A-D control the morphogenesis of the urogenital system (which regulates the inner salt concentrations) and of the autopodium. This euryhalynity explains the worldwide distribution of the tetrapods during the Late Devonian. It also fits with the earliest tetrapod trackways found in marine tidal sediments from the Middle Devonian of Poland.

Later, this plesiomorphic euryhalinity (re)appeared in many temnospondyl groups: the basal *Iberospondylus* from the Carboniferous of Spain is one of the first known euryhaline temnospondyl. This trait seems less common during the Permian, but it could be masked by the fact that most Permian temnospondyl localities are lacustrine. Temnospondyl euryhalinity is well visible after the Permian-Triassic extinction in various stereospondyl groups such as trematosaurians (e.g., *Aphaneramma* from the Triassic of Spitzberg), capitosaurians (e.g., *Edingerella* from the Triassic of Madagascar), and plagiosaurids (e.g., *Gerrothorax* from the Triassic of Germany).

How to explain this capacity to support various concentrations of salts in these amphibians? Living amphibians (i.e., lissamphibians) do not support very salty waters and do not seem appropriate for comparisons. Halotolerant and/or marine living amniotes such as sea turtles or seabirds may better help for actualistic reconstructions. Osmoregulatory organs such as kidneys, functional salt glands, or supraorbital glands are reviewed, and their hypothetic presence and role inferred in temnospondyls. The problem is that these labile organs do not leave compulsory traces on bones. Yet orbits, nostrils, and other cranial fenestrae, as well as endocranial and/or palatal bony processes, of peculiar shape and texture could accommodate such glands.

Technical Session III (Wednesday, November 5, 2014, 2:00 PM)

NEW ANATOMICAL DETAILS OF THE BASAL CERATOSAUR *LIMUSAURUS* AND IMPLICATIONS FOR THE JURASSIC RADIATION OF THEROPODA

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The basal ceratosaur *Limusaurus inextricabilis* from the Upper Jurassic (Oxfordian) Shishugou Formation of Xinjiang, China is notable for being the earliest edentulous theropod, the first ceratosaur known from Asia, and the only non-avian theropod known to display strong bilateral digital reduction. Here we present new details of its anatomy based on our study of 18 articulated or associated skeletons, including several young juveniles, and an analysis of its phylogenetic relationships.

Computed tomography (CT) reconstruction of a three-dimensionally preserved skull reveals an unusual pattern of quadrate pneumaticity and the structure of the palate. Pneumatic features of the posterior cervical and anterior dorsal vertebrae are present only in *Limusaurus* and other gracile ceratosaurs such as *Masiakasaurus* among non-avian theropods. Characteristic features of Abelisauroidea such as the relative development of prezygapophyseal-epipophyseal laminae in cervical vertebrae and double blood vessel traces in pedal unguals are individually, bilaterally, and serially variable in *Limusaurus*. This indicates that these features may be useful for diagnosing taxa as ceratosaurian, but have the potential to mislead taxonomic hypotheses for fragmentary taxa.

Morphologies from throughout the skeleton suggest that *Limusaurus* is a noasaurid ceratosaur, and a phylogenetic dataset built to test the relationships of basal Neotheropoda corroborates these observations through parsimony and Bayesian analyses. Optimization of manual characters suggests that the manual morphology of *Limusaurus* is unlikely to be representative of the averostran ancestor as previously hypothesized. However, we argue that the presence of bilateral digit reduction in *Limusaurus* and other ceratosaurs remains a key piece of evidence for understanding theropod digit homologies.

New anatomical insights from *Limusaurus* and other ceratosaurs we surveyed reveal that several Jurassic specimens from Laurasian landmasses previously referred to Coelophysoidea and Tetanurae can be identified as either stem averostrans or ceratosaurs. These discoveries reduce the typically long ghost-lineages recovered by other authors near the base of Averostra. Ceratosaur diversity known from northern landmasses now exceeds that from Gondwana during the Jurassic, though ceratosaurs achieve peak success in Gondwana during the Cretaceous. This research was supported by the National Geographic Society and NSF award numbers 1311000, EAR 0922187, and EAR 0310217.

Poster Session IV (Saturday, November 8, 2014, 4:15 - 6:15 PM)

MORPHOLOGICAL DATA FOR *CRYPTAGAMA AURITA* YIELD NEW INSIGHTS INTO THE ENDEMIC AUSTRALIAN AGAMID LIZARD RADIATION

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The endemic Australian agamid lizard fauna represents a diverse and biogeographically interesting radiation that remains poorly understood. Phylogenetic analyses of both morphological and molecular data yield alternative hypotheses for relationships within the endemic radiation. Numerous fossil deposits across the continent contain fossilized remains of agamid lizards, but those materials remain unpublished and poorly studied. Adequate understanding of the fossil record and holistic perspectives on phylogenetic relationships within the group require detailed knowledge of skeletal morphology. Morphological data are deficient for the majority of Australian agamids and are completely absent for several taxa. One of those is the rare and enigmatic *Cryptagama aurita*. The species is known from only four specimens; a fifth individual recently was photographed, but not collected nor were tissue samples collected. There are no tissues available, and no skeletal preparations exist. We computed tomography (CT) scanned two specimens of *Cryptagama aurita*, including a relatively large individual, and an obviously juvenile specimen. *Cryptagama aurita* shares several features of the skull and mandible only with the bizarre thorny devil, *Moloch horridus*. Those characters include a lingual process of the coronoid bone that does not extend ventrally to the lower margin of the mandible, lack of caniniform teeth (also possibly absent in *Chelosania*), a reduced nasal that weakly meets the facial process of the maxilla, a weakly developed ventrolateral process of the basioccipital, and a flattened quadrate process of the pterygoid. Those features are not shared by any other endemic Australian agamids, are absent in the outgroups to that clade (e.g., *Physignathus*, *Agama*), and represent a derived condition within the Australian clade. These data provide the first hard evidence for a close relationship between *Cryptagama* and *Moloch*.

Poster Session II (Thursday, November 6, 2014, 4:15 - 6:15 PM)

CRACKING DINOSAUR ENDOTHERMY: PALEOPHYSIOLOGY UNSCRAMBLED

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The amniote eggshell functions as a respiratory structure adapted for the optimal transmission of respiratory gasses to and from the embryo according to its physiological requirements. Therefore amniotes with higher oxygen requirements, such as those that sustain higher metabolic rates, can be expected to have eggshells that can maintain a greater gas flux to and from the egg. Studies of extant amniotes have found that eggshells of reduced porosity impose a limit on the metabolic rate of the offspring. Here we show a highly significant relationship between metabolic rates and eggshell porosity in extant amniotes that predicts highly endothermic metabolic rates in dinosaurs. This study finds the eggshell porosity of extant endotherms to be significantly higher than that of extant ectotherms. Eggshell porosity values of dinosaurs are found to be significantly higher

than that of extant ectotherms, but not extant endotherms. Dinosaur eggshells are commonly preserved in the fossil record, and porosity may be readily identified and measured. This provides a simple tool to identify metabolic rates in extinct egg-laying tetrapods whose eggs possessed a mineralized shell.

Technical Session VII (Thursday, November 6, 2014, 8:30 AM)

EARLY ARCHOSAUROMORPH DISPARITY IS REPEATED BY DINOSAURS: CONVERGENCE OF PACHYCEPHALOSAURID CRANIAL MORPHOLOGY BY A NEW DOME-HEADED ARCHOSAURIFORM FROM THE UPPER TRIASSIC OF TEXAS

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Archosauromorph reptiles (i.e., crown archosaurs and their close relatives) possess disparate cranial morphologies and a diversity of body plans and sizes, which are unmatched by other contemporary vertebrates in the Mesozoic Era. Particularly in the Triassic, archosauromorph disparity was high and general body plans of some archosauromorphs (e.g., azendohsaurids, shuvosaurids, aetosaurs) were repeated later in the Mesozoic by other groups of archosaurs (e.g., early sauropodomorphs, ornithomimids, ankylosaurs). Here we present a case of convergence between a new early archosauriform from the early Late Triassic Otis Chalk vertebrate fossil assemblage of the Dockum Group of Texas and Cretaceous pachycephalosaurid dinosaurs. Like pachycephalosaurs, this Triassic specimen preserves a thickened and domed skull roof with obliterated cranial sutures, an expanded posterior margin of the skull (a synapomorphy of Marginocephalia), and large orbits. This new taxon possesses a large pineal foramen and an ossified orbital septum formed by the laterosphenoids. Computed tomographic data of this new taxon reveal large, laterally expanded olfactory bulbs and a complete, well-preserved left osseous labyrinth. The anterior semicircular canal has the largest diameter of the three canals, indicating increased sensitivity to changes in pitch. Though the facial region is incomplete, reconstruction of normal head posture from the orientation of the lateral semicircular canal with respect to the occipital condyle indicates the skull roof was held at a steep angle with the frontal region oriented almost entirely anteriorly and the parietal-squamosal region oriented in a nearly transverse plane. We included this specimen in a recent cladistic analysis of Archosauromorpha and found it as an early diverging archosauriform based on the presence of an antorbital fenestra and associated fossa in the lacrimal and an ossified laterosphenoid. The similarity between this new taxon and the cranial modifications of pachycephalosaurs over 100 million years later illustrates the early exploration of cranial morphospace in the Triassic. Distinctive cranial morphologies and modifications seen in Jurassic and Cretaceous dinosaurs are being found increasingly often in Triassic archosauromorphs. The acquisition of those cranial configurations implies that faunal and ecological shifts interpreted to occur among dinosaurs later in the Mesozoic possibly occurred much earlier, during the Triassic archosauromorph radiation.

Poster Session III (Friday, November 7, 2014, 4:15 - 6:15 PM)

A NEW STEREOSPONDYLOMORPHA TEMNOSPONDYL FROM THE MIDDLE/LATE PERMIAN OF SOUTH BRAZIL

STRAPASSON DE SOUZA, Adriana, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil; LIMA PINHEIRO, Felipe L., Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil; BENTO SOARES, Marina, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

Temnospondyl amphibians have already been recorded in the fluvio-lacustrine deposits from the top of the Meso/Neopermian sequence from the Paraná Basin (Rio do Rasto Formation, South Brazil). This record includes *Australerpeton cosgriffi*, *Bageherpeton longignathus*, a short-snouted skull, a hemimandible, and a nearly complete skull not formally described. In this work a new temnospondyl is described. The material consists of disarticulated cranial and postcranial elements, preserved in association. The cranial elements include part of the orbital region of the skull roof, the basicranium, a number of endocranial elements, stapes, and a right hemimandible. The postcranial elements include vertebrae, ribs, pectoral girdle elements, a right femur, and a cluster of scales. This specimen is distinguished from all other temnospondyl taxa by the presence of the following combination of characters: epipterygoid robust with an elongated blade-like anterior process; broad sutural contact between parasphenoid and pterygoid; very elongated and deep muscular 'pockets' of parasphenoid, anterolaterally limited by very developed and sharp muscular crests that extend upward over the lateral side of the exoccipital condyles; small basioccipital ossification, visible only in occipital view, contributing to the exoccipital condyles; shagreen denticles on pterygoids and parasphenoid; and foramen for the internal carotid artery lying at the posterolateral corner of the parasphenoid, posterior to the pterygoid articulation. A phylogenetic analyses was performed using TNT v. 1.1 and based on a recently published dataset, resulting in 67 equally parsimonious trees of 633 steps (CI = 0.36, RI = 0.8). The phylogenetic analysis grouped the new material and *Australerpeton cosgriffi* in a monophyletic sister group inside Stereospondylomorpha. The study material displays a rhinesuchid pattern, which is similar to the South African rhinesuchids from the upper Permian Beaufort Group of the Karoo Basin, but differs from them by the presence of a robust and elongated epipterygoid with a blade-like anterior process in addition to elongated and deeper muscular pockets of parasphenoids, which allow the inclusion of this specimen into a new species. The new taxon will provide interesting data for biostratigraphic studies, which are already in progress. Funded by a student grant from Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

Poster Session I (Wednesday, November 5, 2014, 4:15 - 6:15 PM)

AN EMENDED DIAGNOSIS OF *MOSASAURUS HOFFMANNII* TO CLARIFY THE CONCEPT OF *MOSASAURUS*

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The first mosasaur fossils were discovered in the chalk quarries near Maastricht during the late 16th century. The second of these finds, referred to as "le grand animale fossile des carrières de Maastricht", received a great deal of contemporary attention, but the true affinities of the specimen remained unknown for many years. This confusion represented just the precursor to the taxonomic issues that have continued to plague the taxon. The binomial *Mosasaurus hoffmannii* was erected prior to the establishment of an internationally accepted code of nomenclature, spanning 21 years from description to erection of the specific epithet, with no description or diagnosis accompanying either the genus or the species name. While modern authors have diagnosed both the genus and the species, these diagnoses are incomplete and vague leading to *Mosasaurus* becoming a poorly defined waste basket taxon, with numerous weakly justified species assigned to it. We herein present the following much-needed emended diagnosis of *Mosasaurus hoffmannii* based on detailed study of the type specimen from the Museum National d"Histoire Naturelle in Paris MNHN AC9648: maxilla with little to no excavation for external naris; maxilla bearing 13 teeth; pterygoid tooth row straight, bearing 8 small, posteriorly curved, posteriorly carinate teeth; quadrate tall with short, curved suprastapedial process; infrastapedial process reduced; rim of tympanic ala grooved with distinct anterodorsal and anteroventral corners; dentary bearing 14 teeth; marginal dentition faceted and asymmetrically bicarinate; post-dentary unit height approximately half of length; femur greatly expanded medially and distally with long axes of articular surfaces perpendicular and internal trochanter robust and offset. Stabilization of the generic type around a robust diagnosis clarifies the concept of *Mosasaurus* by defining the species *hoffmannii*. Assessment of the morphology of existing species currently assigned to *Mosasaurus* results in the recognition of six diagnosable species.

Edwin H. and Margaret M. Colbert Prize Competition (posters displayed November 5 – 8, judging occurs Thursday, November 6)

EVOLUTIONARY BOTTLENECK OF MARINE REPTILES DURING THE TRIASSIC-JURASSIC TRANSITION

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Mesozoic marine ecosystems were inhabited by a disparate array of diapsid reptiles. The most diverse and varied group, Sauropterygia, spanned the entire Mesozoic and occupied a broad range of trophic niches throughout their evolutionary history. However, plesiosaurs were the only sauropterygians to transcend the Triassic-Jurassic transition, with other clades becoming extinct during the Late Triassic. Our aim was to test how this loss of phylogenetic diversity impacted patterns of morphological and potential ecological diversity in Sauropterygia, and assess if the group passed through an evolutionary 'bottleneck' at the Triassic-Jurassic boundary. We examine two elements of variation: cranial shape (morphology) and size. Geometric morphometrics and multivariate disparity analyses were implemented to calculate morphological variation. Our analyses reveal that Triassic sauropterygians (placodonts, nothosaurs and pachypleurosaurs) were significantly more morphologically disparate than Jurassic and Cretaceous plesiosaurs. At no point during the Jurassic or Cretaceous did sauropterygians achieve levels of morphological disparity equaling those in the Triassic. This provides robust support for the hypothesis that a loss of sauropterygian lineages during the Late Triassic reduced the clade's potential for generating morphological variation. In contrast, our analysis of size reveals that Jurassic and Cretaceous plesiosaurs explored a far greater range of cranial sizes, despite the disappearance of extremely small forms. This hints that Triassic sauropterygians and plesiosaurs explored variation differently, with Triassic lineages evolving disparate cranial shapes within a small size range, while plesiosaurs explored a great range of sizes but only limited shapes. Overall, our conclusions, in accordance with previous research on ichthyosaurs, suggest that the extinction of marine reptiles during the Late Triassic had profound effects on subsequent evolution, ecological diversity and ecosystem composition during the Jurassic and Cretaceous.

Technical Session X (Friday, November 7, 2014, 8:45 AM)

SHUITANGBA: A TERMINAL MIOCENE FOSSIL VERTEBRATE SITE IN YUNNAN, CHINA

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The lignite mines in the Zhaotong Basin of Yunnan have been known to be highly fossiliferous since the 1960s, but only a few cursory studies of the area and its fossils had been attempted. Of these, Shuitangba is the first to be systematically collected and studied. Magnetostratigraphic and biostratigraphic studies of the site place its age in the terminal Miocene, about 6 Ma, during the transition to cooler and drier conditions in Eurasia. The fauna is preserved in intercalated deposits of lignite and silty and peaty clays, and includes specimens of Mammalia (Primates, Insectivora, Carnivora, Rodentia, Lagomorpha, Perissodactyla, Artiodactyla, Proboscidea), Aves, Teleostei, Anura, Squamata, Testudines, and Crocodylia. The avifauna of Shuitangba is particularly striking as it is the most abundant component of the fauna and is dominated by a diversity of water birds. Noteworthy among Shuitangba mammals is a juvenile cranium of the hominoid *Lufengpithecus* and a mandible and postcrania of *Mesopithecus*, a colobine monkey. A complete cranium of an otter-like mustelid, *Siamogale*, and remains of diverse insectivoran and rodent species, including beavers, were also recovered.